

Claims:

1. Device to visualize in-line the polymer melting in plasticating screw machines, which comprises an external metallic cylinder to be fixed in radial position regarding the barrel of the plasticating machine, a bushing with an optical window clear to the visible light spectrum resistant to pressure and temperature, positioned in such a way that its external face is tangent to the internal surface of the barrel of the plasticating machine, and an internal metallic cylinder to guide the coolant gas and allow the use of an observation probe with operating temperature limits and an illumination system.
2. Device according to claim 1 to be screwed on or installed in plasticating screw machines, such as single screw extruders or extruders with more than one screw, blow molding and injection molding machines.
3. Device according to claims 1 and 2 characterized because the transparent optical window is manufactured of quartz, glass or sapphire with a maximum thermal resistance up to 1000 °C.
4. Device according to claims 1, 2 and 3, characterized because the optical window is small, round and has a diameter equal to or less than 10mm to not significantly affect the thermal regime of the plasticating screw machine.

5. Device according to claims 1, 2, 3 and 4, characterized because the optical window has a minimum thickness of 6 mm to ensure the pressure resistance existing inside the plasticating screw machine.
6. Device according to claims 1, 2, 3, 4 and 5 characterized because the optical window can be replaced in case of damage.
7. Device according to claims 1, 2, 3, 4, 5 and 6 characterized because the bushing with the optical window is a ring made of a deformable material and self-sealant under temperature and pressure.
8. Device according to claims 1, 2, 3, 4, 5, 6 and 7 characterized because the bushing is a thermoplastic material that does not melt at the operating temperature of the plasticating machine and is deformable to guarantee the self-sealant effect.
9. Device according to claim 1 characterized because the internal metallic cylinder possesses on its surface a spiral, baffles or deflectors to guide the coolant gas throughout its length, to have good heat removal and preserve the observation probe with operating temperature limits and with illumination system.
10. Device according to claim 1 characterized because the external metallic cylinder possesses two connections, one for the inlet and another for the outlet of the coolant gas.

11. Method to quantify the polymer melting in plasticating screw machines through the device of claims 1 to 10, which is characterized due to the in-line visualization of the process, in real time, safely and not significantly affecting its thermal regime.
12. The method to quantify the polymer melting in plasticating screw machines of claim 11 characterized by the following stages:
 - Location of several devices according to claims 1 to 10 along the length of the barrel of the plasticating screw machine.
 - In-line visualization of the polymer inside the machine, either in solid, melt state or in co-existing states, through an observation probe placed in the device of claims 1 to 10.
 - Joint calibration of the device's optical window according to claims 1 to 10 and of the observation probe to determine the relationship between the visualized image and the quantified image in pixels, and thus, guarantee the precision of the measurements from the observed images.
 - Recording of the polymer's plasticating process by capturing the images in-line and the experimental data from the inside of the plasticating screw machine with a camera and a video recorder.

- Determination of the solids bed's position and width from the obtained images, operating conditions and plasticating machine's geometry using an image analyzer program or software.
- Calculation of the polymer's melting profile visualized in the plasticating screw machine.

References:

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